sending and receiving side not being at the same rate are reduced. An LPC-residual is modified on a sample-by-sample basis. The LPC-residual block, which includes N samples, is converted to a block comprising N+1 or N-1 samples. A sample rate controller decides whether samples should be added to or removed from the LPC-residual. The exact position at which to add respective remove samples is either chosen arbitrarily or found by searching for low energy segments in the LPC-residual. A speech synthesiser module then reproduces the speech. By using the proposed sample rate conversion method the playout buffer can be continuously controlled. Furthermore, since the method works on a sample-by-sample basis the buffer can be kept to a minimum and hence no extra delay is introduced.

IN THE CLAIMS

Please amend the claims as follows:

1. (AMENDED)   A method of improving speech quality in a communication system comprising a first terminal unit (TRX1) and a second terminal (TRX2), the method comprising:

transmitting speech signals having a first sampling frequency (F_1);

receiving said speech signals;

buffering said speech signals in a playout buffer with said first frequency (F_1);

playing out said speech signals with a second frequency (F_2);

performing a dynamic sample rate conversion of a speech frame comprising N samples on a sample by sample basis, said dynamic sample rate conversion comprising:

creating an LPC-residual comprising N samples derived from said speech frame;

calculating, for each speech frame, whether a sample should be either added or removed from said LPC-residual;

generating a modified LPC-residual comprising at least one of N-1 and N+1 samples, in response to a determination that said calculating so demands; and

synthesising a speech signal from said modified LPC-residual.

2. (AMENDED)   The method of claim 1 wherein the creating step comprises performing an LPC-analysis of the speech frame in order to find LPC-parameters of said speech frame.

3. (AMENDED)   The method of claim 1 wherein the creating step comprises using already existing LPC-parameters from a speech decoder.

4. (AMENDED)   The method of claim 1 wherein the creating step comprises using an existing LPC-residual from a decoder.

5. (AMENDED)   The method of claim 1, wherein the calculating step comprises deciding whether a sample should be added or removed based on at least one of the following inputs:

sample frequencies of the sending (TRX1) and receiving (TRX2) terminal units;

a voice activity detector signal;

a status of the playout buffer; and

an indicator of a beginning of a talkspurt.

6. (AMENDED)   The method of claim 1, wherein the generating step comprises:

selecting a position in the LPC residual at which to add or remove a sample; and

adding respective removing of said sample.

7. (AMENDED)   The method of claim 6 wherein the step of selecting said position is performed arbitrarily.

8. (AMENDED)   The method of claim 6 further comprising the step of finding said position via a search for a segment of the LPC-residual with low energy.

9. (AMENDED)   The method of claim 8 wherein said segment of low energy is found via a block energy analysis.

10. (AMENDED)   The method of claim 8 wherein said segment of low energy is found via a sliding window energy analysis.

11. (AMENDED)   The method of claim 6 wherein said position is found using knowledge about a position of a pitch pulse and knowledge about a time difference between said pitch pulse and a following pitch pulse to select the position at which to add or remove a sample in the LPC-residual.

12. (AMENDED)   The method of claim 11 further comprising the step of finding said pitch pulse via a search for positions in the LPC residual with high energy.

13. (AMENDED)   The method of claim 12 wherein said positions with high energy are found via a block energy analysis.

14. (AMENDED)   The method of claim 12 wherein said positions with high energy are found via a sliding window energy analysis.

15. (AMENDED)   The method of claim 6 wherein said adding comprises adding a zero sample.

16. (AMENDED)   The method of claim 6 wherein said adding comprises adding a zero sample and interpolating surrounding samples.

17. (AMENDED)   The method of claim 6 wherein said removing comprises

removing a sample from the LPC-residual.

18. (AMENDED)   The method of claim 6 wherein said adding comprises:

adding a sample in a history of the LPC residual; and

increasing a lag pointer so long as the adding is within an LPC residual history.

19. (AMENDED)   The method of claim 6 wherein said removing comprises:

removing a sample in a history of the LPC residual; and

decreasing a lag pointer so long as the removing is within the LPC residual

history.

20. (AMENDED)   The method of claim 6 wherein the second terminal unit

comprises an adaptive and a fixed codebook; and

wherein said adding comprises:

adding a sample in an output from the adaptive codebook;

extending an output from the fixed codebook; and

increasing a lag pointer so long as the adding is within the LPC residual history.

21. (AMENDED)   The method of claim 6 wherein the second terminal unit

comprises an adaptive and a fixed codebook; and

wherein said removing comprises:

removing a sample in an output from the adaptive codebook;

shortening an output from the fixed codebook; and

decreasing a lag pointer so long as the removing is within the LPC residual history.

22. (AMENDED)   The method of claim 6 wherein the second terminal unit comprises a fixed codebook; and

wherein said adding or removing comprises adding or removing a sample in an output from the fixed codebook.

23. (AMENDED)   An apparatus for improving speech quality in a communication system comprising a first terminal unit (TRX1) adapted to transmit speech signals and having a first sampling frequency (F_1) and a second terminal unit (TRX2) adapted to buffer said speech signals in a playout buffer with said first frequency (F_1) and to play said speech signals out with a second frequency (F_2), said apparatus comprising:

means for performing a dynamic sample rate conversion of a speech frame comprising N samples on a sample by sample basis, wherein said dynamic sample rate conversion comprises:

means for creating an LPC-residual comprising N samples derived from said speech frame;

means for calculating for each speech frame whether a sample should be added

or removed from said LPC-residual;

means for generating a modified LPC-residual comprising at least one of N-1 and N+1 samples in response to a determination that said calculating so demands; and

means for synthesising a speech signal from said modified LPC-residual.

24. (AMENDED)   The apparatus of claim 23 wherein the means for creating comprises means for performing an LPC-analysis of the speech frame to find LPC-parameters of said speech frame.

25. (AMENDED)   The apparatus of claim 23 wherein the means for creating comprises means for using existing LPC-parameters from a speech decoder.

26. (AMENDED)   The apparatus of claim 23 wherein the means for creating comprises means for using an existing LPC-residual from a decoder.

27. (AMENDED)   The apparatus of claim 23, wherein the means for calculating comprises means for deciding if a sample should be added or removed on the basis of a function of at least one of the following inputs:

sample frequencies of sending and receiving terminal units;

a voice activity detector signal;

a status of the playout buffer; and

an indicator of a beginning of a talkspurt.

28. (AMENDED)   The apparatus of claim 23, wherein the means for generating

comprises:

    means for selecting a position at which to add or remove samples; and

    means for performing adding and removing.

29. (AMENDED)   The apparatus of claim 28 wherein the means for selecting

comprises means for arbitrarily selecting said position at which to add or remove

samples.

30. (AMENDED)   The apparatus of claim 28 wherein the means for selecting

comprises means for searching for the segment of the LPC-residual with the lowest

energy.

31. (AMENDED)   The apparatus of claim 30 wherein the means for searching

comprises means for performing a block energy analysis.

32. (AMENDED)   The apparatus of claim 30 wherein the means for searching

comprises means for performing a sliding window energy analysis.

33. (AMENDED)   The apparatus of claim 28 wherein the means for selecting

comprises means for using knowledge about a position of a pitch pulse together with

knowledge about a time difference between said pitch pulse and a following pitch pulse

to select the position at which to add or remove a sample in the LPC-residual.

34. (AMENDED)   The apparatus of claim 33 wherein the means for using

knowledge about pitch pulses comprises means for finding the pitch pulses by searching

for positions in the LPC residual with high energy.

35. (AMENDED)   The apparatus of claim 34 wherein the means for finding pitch

pulses comprises means for performing a block energy analysis.

36. (AMENDED)   The apparatus of claim 34 wherein the means for finding pitch

pulses comprises means for performing a sliding window energy analysis.

37. (AMENDED)   The apparatus of claim 28 wherein the means for performing

adding or removing comprises means for adding a zero sample.

38. (AMENDED)   The apparatus of claim 28 wherein the means for performing

adding or removing comprises means for removing a sample from the LPC-residual.

39. (AMENDED)   The apparatus of claim 28 wherein the means for performing adding or removing comprises means for adding a zero sample and interpolating surrounding samples.

40. (AMENDED)   The apparatus of claim 28 wherein the means for performing adding or removing comprises:

   means for adding a sample in a history of the LPC residual; and

   means for increasing a lag pointer so long as the adding is within the LPC residual history.

41. (AMENDED)   The apparatus of claim 28 wherein the means for performing adding or removing comprises:

   means for removing a sample in a history of the LPC residual; and

   means for decreasing a lag pointer so long as the removing is within the LPC residual history.

42. (AMENDED)   The apparatus of claim 28 wherein the second terminal unit comprises:

   an adaptive and a fixed codebook;

   means for adding a sample in an output from the adaptive codebook;

   means for extending an output from the fixed codebook; and

means for increasing a lag pointer so long as the adding is within the LPC residual history.

43. (AMENDED)   The apparatus of claim 28 wherein the second terminal unit comprises:

an adaptive and a fixed codebook;

means for removing a sample in an output from the adaptive codebook;

means for removing a sample in an output from the fixed codebook; and

means for decreasing a lag pointer so long as the removing is within the LPC residual history.

44. (AMENDED)   The apparatus of claim 28 wherein the second terminal unit comprises:

a fixed codebook; and

means for adding or removing a sample in an output from the fixed codebook.